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STRATEGIC PROJECT MANAGEMENT AT THE NASA KENNEDY SPACE CENTER

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ABSTRACT

This paper describes Project Management at NASA's Kennedy Space Center (KSC) from a strategic perspective. It develops the historical context of the agency and center's strategic planning process and illustrates how now is the time for KSC to become a center which has excellence in project management. The author describes project management activities at the center and details observations on those efforts. Finally the author describes the Strategic Project Management Process Model as a conceptual model which could assist KSC in defining an appropriate project management process system at the center.

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1. INTRODUCTION

In the past twenty years many types of organizations have felt the pressure to be more responsive to those parties to whom they are accountable. In the early 1980's it was the Japanese and Germans who forced American industries to look at their attitude toward customer (internal and external) satisfaction. In the late 1980's service industries and product producers in nearly all industrial sectors recognized this need. Later it was the healthcare industry as well as government organizations that heard the call to more effectively manage the processes that produce utility for their customers (again internal and external).

In the case of the National Aeronautics and Space Administration (NASA) the organizational "call to action" was clearly heard in the early 1990's. Drivers such as the new congress, vice-president Gore's re-inventing government initiative, voter expectations for increased accountability and the Government Performance and Results Act all meant that it was time for NASA to act — and act it did. From the early beginnings of the strategic planning process right up to today, NASA has answered the call, and has firmly rooted itself as the key government entity ready to lead the nation's space program into the next millennium.

This paper briefly develops NASA and Kennedy Space Center's (KSC) strategic planning process from the early 1990's to today. It discusses what impact that process has had on the agency and specifically the center and illustrates how project management (PM) is a natural result of that process at KSC. It discusses current PM activity at the center and finally concludes with a description of the Strategic Project Management Process Model (SPMPM) and its uses in the previously developed strategic environment and context.

2. STRATEGIC PLANNING AT NASA AND KENNEDY SPACE CENTER

Strategic planning is a process whereby an organization evaluates its mission, guiding principles and overarching *raison d'être* and establishes its objectives, goals and plans. This process focuses organizations on their internal strengths and weaknesses and the opportunities and threats that exist in their environment. From this, strengths are capitalized on and weaknesses improved, and external opportunities and threats are recognized. Strategic planning focuses an organization on short term, medium term and long term goals and plans, and produces action with the organization's resources to be successful in each of those time frames. When done correctly strategic planning provides a framework from which every activity that the organization engages in ties directly to achieving its goals. In this way all decision makers, all workers, and all people in the organization understand how their own work connects, and has meaning in, the big picture of what the organization is reaching to accomplish.

Strategic planning is a very important organizational tool that has been used by most every major company in most every industrial and service sector. It is a tool that has been used in hospitals, schools and school systems, churches, universities, non-profit and community service and many other types of organizations.

The Government Performance and Results Act of 1993 (GPRA-93) and the National Performance Review were the federal legislative catalysts that precipitated NASA's movement in the direction of agency-wide strategic planning. The Act itself was a formal proclamation to all federal government entities that they need to become more accountable for the nation's resources which they manage. Table 1, from the GPRA-93, illustrates the findings and basic purposes behind the Act. *Findings* in the Act include items such as: waste and inefficiency in programs, insufficient articulation of goals, and insufficient attention to performance and results; and *Purposes* include: improve accountability,

initiate performance reform, focus on results/service quality/customer satisfaction, improve congressional decision making and overall management of the Federal Government.

Table 1

Government Performance and Results Act 1993, Findings and Purposes [1]

SEC. 2. FINDINGS AND PURPOSES.

(a) FINDINGS- The Congress finds that:

1. Waste and inefficiency in Federal programs undermine the confidence of the American people in the Government and reduces the Federal Governments ability to address adequately vital public needs;
2. Federal managers are seriously disadvantaged in their efforts to improve program efficiency and effectiveness, because of insufficient articulation of program goals and inadequate information on program performance; and
3. Congressional policymaking, spending decisions and program oversight are seriously handicapped by insufficient attention to program performance and results.

(b) PURPOSES- The purposes of this Act are to:

1. Improve the confidence of the American people in the capability of the Federal Government, by systematically holding Federal agencies accountable for achieving program results;
2. Initiate program performance reform with a series of pilot projects in setting program goals, measuring program performance against those goals, and reporting publicly on their progress;
3. Improve Federal program effectiveness and public accountability by promoting a new focus on results, service quality, and customer satisfaction;
4. Help Federal managers improve service delivery, by requiring that they plan for meeting program objectives and by providing them with information about program results and service quality;
5. Improve congressional decision making by providing more objective information on achieving statutory objectives, and on the relative effectiveness and efficiency of Federal programs and spending; and
6. Improve internal management of the Federal Government.

Federal Government agencies across the board have been affected by this legislation and there has been a true "re-inventing of government" because of it. Table 2 lists federal programs that have developed case studies from their GPRA-93 initiated strategic planning processes.

Max Weber developed the bureaucratic model of organizational design in the 1940s as a means for standardization and structure in communication, authority, and chain of command [2]. These principles were meant to lead to a more focused, efficient and effective organization, and at that time were new and innovative from a organizational design perspective. However, the word *bureaucratic* itself has been used most recently in a derisive manner to refer to officialism, red tape, proliferation and grid lock in organizational systems. The GPRA-93 was meant to address the very worst of that negative definition.

2.1 STRATEGIC PLANNING AT NASA

NASA's reaction to the strategic planning call was swift and immediate and has been the process through which the agency has transformed itself under the guidance of Mr. Daniel Goldin, NASA Administrator. With a budget that is now 0.7% of the federal budget (compared to a flush 5.7% during the Apollo days) and under 18,000 employees (versus 31,000 in the Apollo days) Mr. Goldin and the NASA management team has molded today's NASA into a diverse, results and customer oriented modern organization.

Table 3 shows the journey that NASA has been through to get to today's "better, faster, cheaper" new NASA.

Table 2

Federal Programs that have developed case studies from their GPRA-93 Initiatives [3]

- Inspector General of U.S. Army Audit Agency
- Research and Development Function of the Army Research Laboratory
- U.S. Coast Guard
- Internal Revenue Service
- Department of Veteran Affairs, National Cemetery System
- National Park Service's Denver Service Center
- National Aeronautics and Space Administration
- Department of State Personnel Security/Suitability Division
- Energy Information Administration
- InterAmerica Foundation
- Public Health Service Healthy People Program
- Pension Guarantee Corporation
- National Science Foundation
- Office of Child Support Enforcement
- National Highway Traffic safety Administration
- Environment Protection Agency
- Bureau of Land Management
- Defense Logistics Agency
- Department of Education
- Social Security Administration
- National Weather Service

Table 3

Journey to the New NASA [4]

- 1915 Congress establishes National Advisory Committee for Aerospace
- 1958 NASA established as part of the National Aeronautics and Space Act
- Developed reputation as a "can do" Agency; successes include: John Glenn's earth orbits, Neal Armstrong's first steps on the moon, landing two Viking spacecraft on Mars, Skylab successes, Shuttle development & missions
- Challenger accident, Post Cold-War drift, Hubble problems, lost Mars Observer
- 1993 Government Performance and Results Act, National Performance Review
- Senior Management Group, Strategic Management Working Group
- NASA Strategic Plan, 25-Year Roadmap
- Strategic Enterprises and Center of Excellence concepts
- Emerged as the New NASA; focused on: development not operations, new frontiers not dead ends, leveraging resources, partnering, and developing value for all stakeholders

Two central concepts that describe the agency from a strategic perspective are Strategic Enterprises and Centers of Excellence. Strategic Enterprises were established to manage the programs and activities of the agency that will implement the mission and "be responsible for answering specific fundamental questions, and satisfy the requirements of NASA's customers." [5]. As given in [5]:

NASA's Strategic Enterprises identify at the most fundamental level what we do and for whom. They focus us on the ends, not the means, of our endeavors. Each of our Strategic Enterprises is analogous to a strategic business unit, employed by private-sector companies to focus on and respond to its customers' needs. Each Strategic Enterprise has a unique set of goals, objectives, and strategies that address the requirements of its primary external customers. However, each Enterprise must ensure synergy with and support of the Agency's common goals and the strategies of the other Enterprises.

NASA has established four Strategic Enterprises as follows: Space Science, Mission to Planet Earth (MTPE), Human Exploration and Development of Space (HEDS), and Aeronautics and Space Transportation Technology (ASTT).

Centers of Excellence are tied to NASA's physical facilities throughout the United States that implement the programs of the agency. These Centers have been established to improve the effectiveness and efficiency of the program and to reduce duplication, overlap and administrative overhead in achieving the goals of the agency. Each physical facility is assigned to lead one or more areas of key competency within the agency. Together the Centers of Excellence describe the body of core competency that the agency possesses for use in achieving its goals and leveraging with customers and suppliers. As in [5]:

Each Center of Excellence represents a focused, Agency-wide leadership responsibility in a specific area of technology or knowledge. Centers of Excellence are chartered with a clear definition of their capabilities and boundaries. They are charged to be preeminent within the Agency, if not worldwide, with respect to the human resources, facilities, and other critical capabilities associated with the particular area of excellence. Each Center of Excellence must maintain or increase the Agency's preeminent position in the assigned area in line with the program requirements of the Strategic Enterprises and the long-term interests of the Agency. The capabilities to support a Center of Excellence can be distributed across multiple Centers. These capabilities are available to all of the Strategic Enterprises.

Figure 1 below describes the eleven Centers of Excellence at NASA and their physical location.

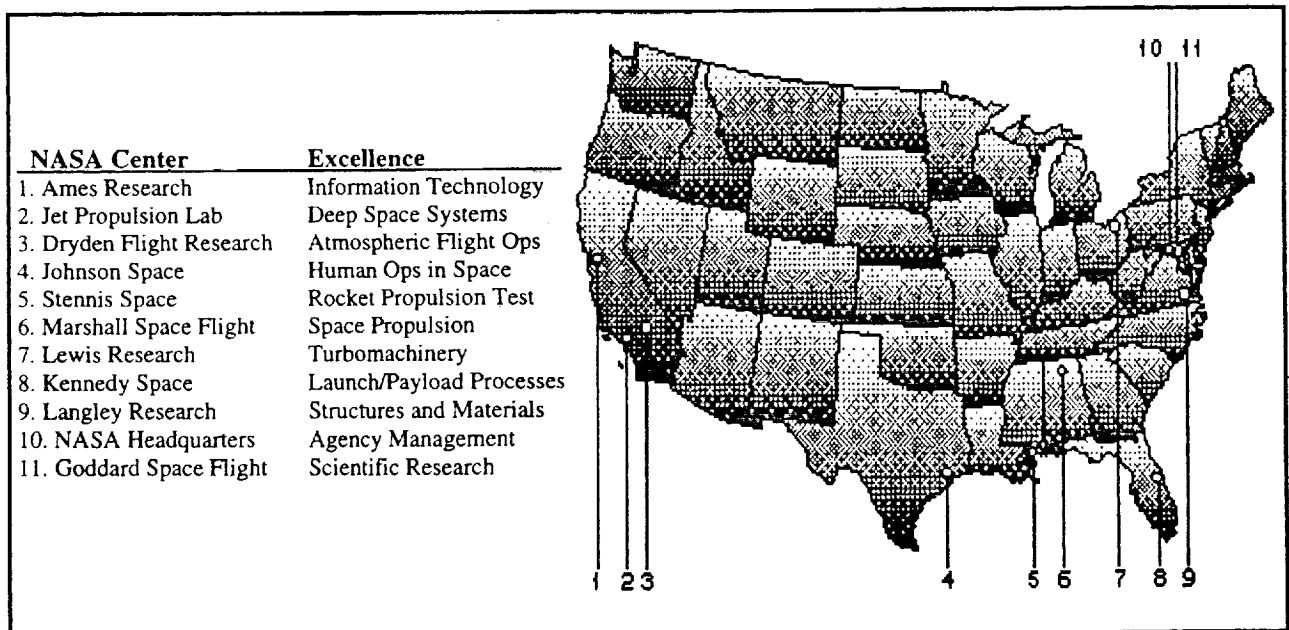


Figure 1: NASA's Centers of Excellence

In general, the strategic planning process at the agency level has been directed toward making NASA: more customer focused, more accountable and more involved with development and resource activities than with sustaining activities. In short NASA seeks to be the developer and creator of space technologies and competency. They seek to be the agency that sets and leads the agenda regarding the how, when, where and why of mankind's exploration and use of space. But at the same time NASA realizes that this must be done in such a fashion that NASA's constituents are satisfied that the agency is a productive and efficient organization worthy of taxpayers investments. By getting out of the space technology management domain and into the space technology innovation domain NASA is taking on that leadership role.

2.2 STRATEGIC PLANNING KENNEDY SPACE CENTER

Kennedy Space Center's role within NASA has been defined through the agency's strategic planning process described above. KSC is assigned to the HEDS Strategic Enterprise which means that all resources, processes, customers and beneficiaries of the output of the center are aligned with human exploration and development of space. Kennedy Space Center is also NASA's *Center of Excellence for Launch and Payload Processing* and the lead center for *Acquisition and Management of Expendable Launch Vehicles, Payload Carriers, Payload Processing and Support*. Thus, from a strategic planning perspective it is clear that Kennedy Space Center exists primarily to be NASA's organizational business unit that maintains knowledge and expertise in space vehicle (and payload) launch and processing competency in support of human exploration and use of space.

Strategic Planning at the agency level has precipitated subsequent planning at the center levels of NASA. These center level plans are required to align with the agency plans in order to achieve overall agency goals. Center plans, by definition will be more specific and task oriented because they are more focused within the overall agency strategic planning process. Kennedy Space Center has responded to agency plans by developing the KSC Road Map and KSC Implementation Plan [6, 7]. These documents form the basis of the what, when, where, how and why of how Kennedy Space Center will achieve its roles within the agency for the next 25 year period.

As management at KSC looks around it finds itself in a very different environment when compared to 10 years ago. The new environment brings with it "better, faster, cheaper" government and a stronger focus on accountability, efficiency and research and development. The use of center resources must be planned, justified, engaged and measured to support of center goals. Tasks must be defined, budgets must be combed and performance, cost and quality attributes measured whenever center resources are utilized. Kennedy Space Center's current and future environment is one where project management (PM) principles can be applied very effectively. Project management seeks first and foremost to: plan and define work; prioritize how resources are used at the organizational level; schedule and cost work content; control project parameters to support goal attainment; and create an environment where success is no accident.

3. PROJECT MANAGEMENT EXCELLENCE

Project management as a body of knowledge has only very recently been organized and promulgated to the masses, although components of this body have been in use for several decades (centuries). There exist many definitions of what project management is [e.g. 8, 9, 10]. One of the most recent attempts at categorizing and defining an aggregate project management body of knowledge is found in *A Guide to the Project Management Body of Knowledge* developed by the Project Management Institute (PMI) [11].

Ketzner develops an interesting chronological progression of the use of project management which ranges from Traditional Project Management (1960-1985), to Renaissance Project Management (1985-1993), to Modern Project Management (1993-present) [12]. In this chronology, the body of

project management knowledge and its use has matured simultaneously based on the needs of organizations using project management, technology and other driving forces. The Traditional period was dominated by large organizations whose focus was on technical completion and cost, where vast resources were applied to projects. Firms in the aerospace, defense and construction industries dominated the use of project management in this period. Massive programs run on mainframe computers dominated in this period. During the Renaissance period companies from many industries began to understand the power of project management principles for directing resources and achieving their goals. Project management was applied to both small and large projects alike. Multidisciplinary teams were common during this period and more focus was placed on company decisions versus project decisions. Personal computer-based project management software gave ready access to sophisticated planning, scheduling and controlling tools during this period. Lastly, during the Modern Project Management period there has been use of increasingly sophisticated tools and techniques in project management by many types of organizations. Companies using project management today do so at the organizational and qualitative levels and want their clients, employees and all stakeholders to see the value of project management in doing business this way. This approach has spawned the term *modern project management* as a way of differentiating it from the way that project management was perceived in the past [12].

What is excellence in project management? In the text *In Search of Excellence in Project Management* excellence in project management is defined as "a continuous stream of successfully managed projects." [12] But what is success? As in our personal lives success is defined individually and interpreted independently. For organizations, success is the same. Kertzner [12] reports that:

A brewery in Venezuela defines a successful project as one that falls within its predetermined time, cost, quality and scope limitations. Disney decides project success is fulfilling its time, cost, and safety requirements, with safety the most important requirement. Brian Vannoni of General Electric's Plastic Group defines success this way: "The technical aspects, timing and costs [in the past] were the three critical areas of performance measurement for our project managers. In today's world, that is not sufficient. We have to also be concerned with environmental and safety regulations, quality, customer satisfaction and ... productivity [of] manufacturing operations. So a project now has at least eight measurables and critical parameters that we gauge success around."

Kertzner stresses that success in project management, like quality in the production of goods and services, must be defined by the customer. His list of factors for project success includes: (1) completed on time, (2) completed within budget, (3) completed at the desired level of quality, (4) accepted by the customer, (5) resulting in customer allowing contractor to use customer as a reference, (6) with minimal scope change, and (7) without disturbing the ongoing business of the company.

Table 4 illustrates the phases of project management maturity that organizations may progress through on their way to creating a project management culture that can produce successful projects.

4. PROJECT MANAGEMENT AT KENNEDY SPACE CENTER

Kennedy Space Center on the whole has had a very mixed use of project management principles. From Table 4 the organization exhibits characteristics from each of the phases of maturity. Yet has not completely progressed through any of them. At the center today there is an increased awareness and visibility of what project management as a discipline and body of knowledge can do to assist KSC in achieving their goals. In moving toward development and research activities and away from sustaining the center: will be more task oriented; will require a higher accountability of their fixed resources; and will need to priority and control driven at the task level. This is an environment where project management principles can be very effectively applied. Mr. Roy Bridges, KSC Center Director, in his

July 27th 1999 KSC Rollout presentation entitled "Vision, Progress and Challenges" alluded to the fact that project management can help KSC at the center level prioritize program opportunities given the current environment of fixed budget and employment resources from the agency. Yet as an center KSC is just beginning to look at project management from a strategic perspective and to in-culture the need for excellence in the PM skills throughout the organization.

Table 4
Phases of Organizational Project Management Maturity [12]

Embryonic Phase	Executive Management Acceptance Phase	Line Management Phase	Growth Phase	Maturity Phase
Recognize need	Get visible executive support	Get line management support	Recognize life cycle changes	Develop a management cost & schedule control system
Recognize benefit	Achieve executive understanding of project management	Achieve line management support	Develop a project management system	Integrate cost and schedule control
Recognize applications	Establish project sponsor	Provide line management education	Make the commitment to planning	
Recognize what must be done	Become willing to change way of doing business	Become willing to release employees to project management	Minimize creeping scope Select a project tracking system	Develop an educational program to enhance project management skills

In looking at the project management activities at the center today several key observations can be made. There is a need for the center to have visibility of all resources engaged in project (or sustaining) activities in order to react to current opportunities and to plan for future opportunities (at the program level). It is required then to be able to roll-up the various project activities to provide this visibility. At the same time it is not completely necessary to establish a single project management office responsible for managing the life-cycle activities of all of center projects. Project management processes that are appropriate for the various types of projects undertaken at KSC can be developed and managed at the office level (where the action is). As an example of the diversity of projects at the center: the LSE budget involves physical launch site equipment enhancements; new special program projects would involve feasibility and exploration activities; CLCS and other on-going projects need support and close-out from a PM perspective; new R&D projects involve proof of concept, basic research, product development and technology creation phases; MM projects involve detailed design and build phases; and FF projects involve grounds, construction and maintenance activities. Each of these types of projects has its own activities, phases and requirements, each has varying involvement with contractors, subcontractors and internal/external units, each has a different involvement of Project Managers (PM) and Project Management Administrators (PMAs).

Thus as a center it may be appropriate to allow for variability in the PM processes depending upon the class of project, its over-arching goals and the phases involved in completing the project. From a strategic perspective, as the center transitions from an operations and sustaining environment to a research and development environment there is a high likelihood that project diversity will exist.

However, if after studying the projects conducted at the center a single PM processes can be developed and administered within a single unit which can roll-up projects for macro-management and also provide for their day-to-day management then this approach may be appropriate. To get to that point the following activities may be undertaken:

1. Investigate the various types of projects currently undertaken and planned for the near term.
2. Classify them in terms of their distinguishing characteristics, including most importantly the overarching goal of the project and likely phases of its life cycle.
3. Be sure to include all potential parties in developing this list of projects and project types.
4. Be sure to include a life cycle perspective of the projects under consideration including the specific characteristics of the life cycle (who is involved, what is done, etc.).
5. Develop a master list of appropriate local processes for each project classification, be sure to include all stakeholders (NASA and contractors) in this activity including the ultimate customer of the project work.
6. Evaluate the relative merits of a single center-wide PM process or a process that allows local control with a visibility activity at the macro-level.

In following these steps the Strategic Project Management Process Model described in the next section would be of great value to center.

5. THE STRATEGIC PROJECT MANAGEMENT PROCESS MODEL

The Strategic Project Management Process Model (SPMPM) is a conceptual model to be developed to assist KSC as it builds appropriate project management processes at the center. On a larger scale the model will incorporate a scope beyond specific uses at KSC that should add to the body of knowledge in the general field of project management and thus add to the understanding and effective use of this important (and growing) field. The model involves three distinct phases as illustrated in Figure 2 and is developed upon the assumption that not all project management processes are appropriate for all classes of projects in all environments and for all types of objectives. In the end the model will define and describe the project management processes which are appropriate for specific classes of projects.

The Characterization phase of the model will delineate all possible differentiating project variables. These variable will be identified from tactical, strategic, and environmental perspectives (as well as other), and will be developed from published literature and general specifications of the domains and characteristics in which project management tools are used. The Capture phase of the model classifies these general characteristics into meaningful discriminating factors from which groups of projects can be distinguished. Data from PMI and other discipline resources as well as case data, best practices and theory will be applied in this phase. Once captured the Prescriptive phase will offer an output of the particular project management processes and key variables most appropriate for a given class of projects. In going from the Classification to the Prescriptive phases a rules or knowledge engine will be developed and integrated. This engine will serve to process the specific requirements of the captured class of projects to produce the Prescriptive output. The SPMPM would be very appropriate for organizations developing or establishing new project management processes. It also could be used by organizations who have currently operational processes as a tool to evaluate those existing PM processes and offer recommendations for improvement for a higher level of organizational goal attainment.

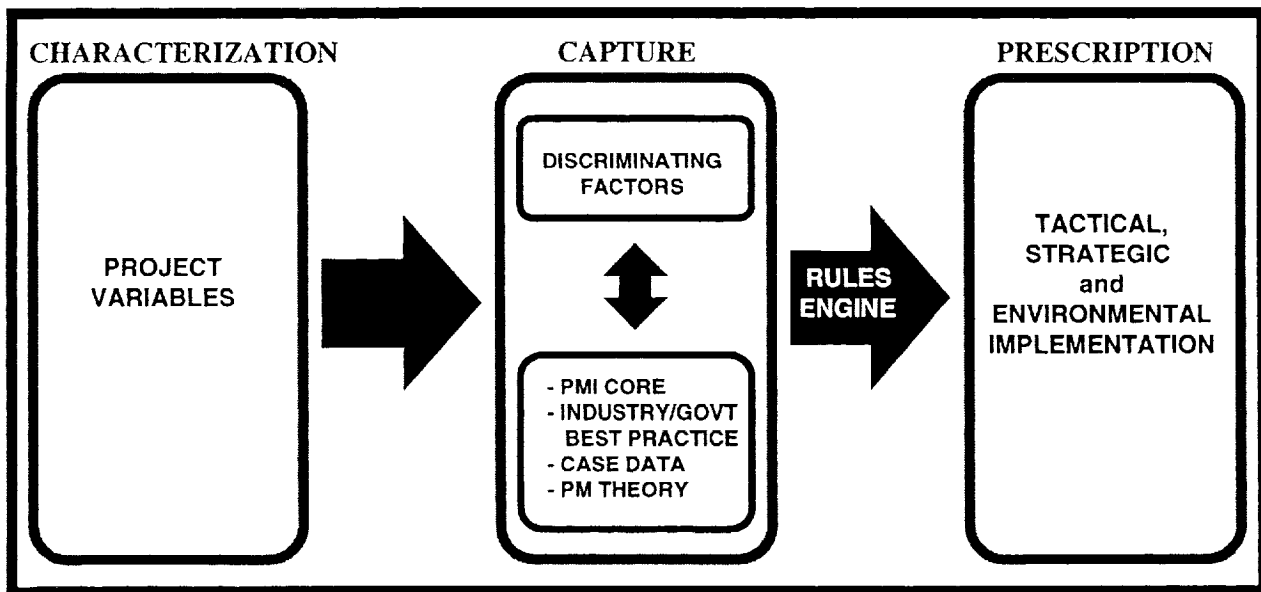


Figure 2: Strategic Project Management Process Model

6. CONCLUSION

NASA's strategic planning process has caused a profound change within the agency over the period of the last 6 years. This process has forced the agency and all of its centers to be more focused, more accountable, more customer driven, and to do more with less in a "better, faster, cheaper" environment. At Kennedy Space Center the strategic planning process has lead to the center positioning itself as the spaceport of choice for government and industry in the United States (and world). Being one of only two sights from which mankind has launched humans into space the center has great knowledge and expertise in the checkout, processing and launch of space vehicle crews and payloads. The challenge for KSC is to build on that knowledge and expertise as space flight changes over the next 50 years. KSC must also develop the physical infrastructure to support such changes.

As KSC moves to a research and development environment to support its goals, expertise in and use of project management principles become critical. Now is the time for KSC to look at the project management processes that will be required to support their overarching goals, to put into place the organizational structure to support these processes, and develop the necessary skills in the workforce so that Kennedy Space Center can claim success in project management. The SPMPM will be developed to provide a prescriptive PM process recommendation when project characteristics are provided. In this way the model will aid and assist organizations as they develop PM processes to support their environment and goals. The model itself is currently at the conceptual design stage and will be further defined and developed as time and interest dictates. This model should be of great use to NASA KSC and other organizations who are using PM as a vehicle toward organizational excellence.

As a final thought, it is this author's opinion that KSC should aspire to be NASA *Center of Excellence in Project Management*. This would involve creating a system for the development of appropriate project management processes, an organizational structure model to support projects for visibility at the macro-management and day-to-day management levels, a training/re-training education/curriculum model for transitioning current workforce skills to include "as needed" project management skills, and an integrated model that illustrates how PM integrates with the strategic planning process to create value and success for the organization. Becoming NASA's PM Excellence Center (or Lead) establishes PM as a priority at the center and seizes agency competency of this critical skill.

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